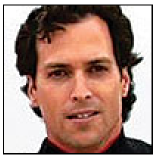
Soapbox

2013: JAN | FEB | MARCH | APRIL | MAY | JUNE | JULY | AUG | SEPT

2012: JAN | FEB | MARCH | APRIL | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC

September 2013 Issue



Hurricane Sandy and Next-Generation Shore Engineering
Harry C. Friebel

Superstorm Sandy was the most devastating storm to impact the northeast in the past 50 years, particularly in northern New Jersey and the metropolitan New York City, New York, area. For those of us working in the fields of coastal engineering and planning, Sandy became the worst-case scenario for this area due to the power of Sandy's waves and the magnitude of storm surge. Sandy also taught us that most people do not understand coastal storm risk.

The risk, however, can be mitigated. Shoreline protection of an engineered beach does work, and one of the lessons learned is that we need to be more creative in the future.

The worst coastal storm of record for the northeast is the Ash Wednesday Storm of March 1962. Nicknamed the "Five High" storm, it lasted three days and five consecutive high-tide cycles and caused its greatest devastation in southern New Jersey and Delaware. This storm caused massive destruction due to its duration and extreme surge (storm-induced water level rise above the astronomically predicted tide). For example, it leveled the beaches and dunes along much of Long Beach Island, New Jersey, and breached the island at five locations, including four in the borough of Harvey Cedars. Many structures in the vicinity of the breach were completely destroyed.

More than 50 years later, the northeast was impacted by another destructive storm: Hurricane Sandy. As Sandy approached the coastline, it generated intense onshore winds, waves and a storm surge that was augmented by astronomical spring tides associated with the full moon of October 29, 2012. Sandy made landfall that same day as a post-tropical cyclone near Atlantic City, New Jersey, with winds of 90 miles per hour, causing extensive flooding, beach erosion and coastal damage along the shorelines of Delaware, New Jersey and New York.

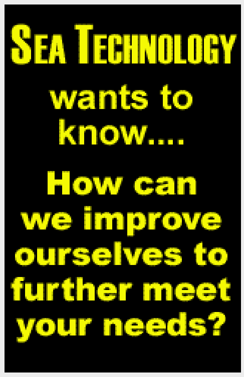
Sandy pushed coastal storm risk management back to the forefront of public and government discussion and highlighted a number of common misconceptions. For instance, the majority of coastal homeowners in the northeast may not understand the inherent risk of living in the coastal zone. Properties located within the Federal Emergency Management Agency 100-year coastal (or inland) floodplain have approximately a 25 percent chance of experiencing flooding during the life of a traditional 30-year mortgage.

In addition, much of the public does not understand the concept of the 100-year flood event, which has a 1 percent chance of being equaled or exceeded during any given year, regardless of recent flooding events. Statistically speaking, at a given location, a 100-year flood or greater can happen two years in a row, or there may be two or more 100-year floods in the very same year. Conversely, 500 years might pass without a 100-year flood at that location. Similarly, a flipped coin has a 50 percent chance of coming up heads, but it is still possible for the coin to come up heads 5, 10 or even 15 times in a row.

Statistics cannot be used to predict the next flood (or coin toss) beyond a simple probability and nobody can accurately predict when the next significant storm will hit. And let us not forget that there is also a risk for storms to exceed the 100-year event (e.g., a 500-year event). The public feedback from Sandy showed that the coastal-protection community is failing at communicating these risks.

Although Sandy caused undeniable devastation for communities along the East Coast, for those of us involved in designing and building coastal storm damage reduction (CSDR) projects, it was satisfying to note the excellent performance of these projects during Sandy. On Long Beach Island, oceanfront homes located behind segments of a constructed CSDR project (dune and berm system) fared far better and experienced significantly less damage than adjacent areas without a constructed project. CSDR projects prevented hundreds of millions of dollars in damages during Sandy, clearly demonstrating the benefits of an engineered beach.

Sandy represents a defining storm that will serve as an engineering case study for a new generation of coastal engineers. Data from Sandy will allow us to evaluate existing beachfill design performance and make improvements to future designs. To date, beachfill has remained the most cost-effective CSDR project option for the open coast. As we look to the future, there are surely a variety of new challenges to be met. For example, sea level rise is predicted to increase ocean levels by at least 8 inches by 2100, which will certainly impact our coastlines. How will governments, scientists, communities, businesses and homeowners manage these changing conditions?



Given that beachfill requires periodic renourishment, this provides opportunities for engineers to adaptively manage sand quantities and adjust designs. Engineers will need to explore additional sand sources as existing sources diminish, and recycling concepts such as backpassing (mechanically moving sand from accreting areas of beach to eroding areas) may become integral to coastal restoration.

Later, as sea level and storm climate changes occur, future coastal engineers will need to become more creative with CSDR projects. Combinations of these projects may become more prevalent (e.g., stone seawall or steel sheet pile located within dune core), or new design concepts will need to be invented. Creativity in CSDR project design will be essential if coastal engineers are to meet the challenges and storms of tomorrow.

Dr. Harry C. Friebel is a coastal engineer with the U.S. Army Corps of Engineers, Philadelphia District. He handles New Jersey coastal storm damage reduction projects, including Long Beach Island, Brigantine Island, Absecon Island (including Atlantic City) and Seven Mile Island (Avalon and Stone Harbor), and is a coastal modeler who works extensively with the Corps's Engineer Research and Development Center, Coastal & Hydraulics Laboratory.